

T19 Combined Heat and Power Systems

1.0 Standards

- .1 Comply fully with the most recent revision, and all amendments, of the following standards:
- BS 7671 Requirements for electrical installations. The IET Wiring Regulations
 - BS EN 60076-3 Power transformers Part 3: Insulation levels, dielectric tests and external clearances in air
 - ENA ER G59/1 Recommendations for the connection of embedded generating plant to the Distribution Network Owner's systems
 - ENA ETR 113 Notes of guidance for the protection of embedded generating plant up to 5MW for operation in parallel with the public electricity suppliers distribution systems
 - IGE/UP/2 Installation pipework on industrial and commercial premises
 - IGE/UP/3 Gas fuelled spark ignition and dual fuel engines

2.0 Description of the Works

2.1 General Requirements

- .1 Supply, install, test and commission a combined heat and power system to generate low temperature hot water (LTHW) and electricity as described upon the drawings and within this specification.
- .2 Ensure that all system components are rated to at least 1.5 times the normal system working pressure.

2.2 System Description

- .1 Install gas fired combined heat and power (CHP) units, as detailed in the Design schedule.
- .2 Install the CHP as a side-stream circuit on the heat network return. Configure the system so that the CHP acts as the lead heat source, and preheats the return water before it reaches the primary return header.
- .3 Install a CHP exhaust from the CHP engine up through the flue riser to roof level.

2.3 G59 Application

- .1 The mechanical contractor is responsible for obtaining permission, from the DNO/IDNO, for the CHP to be connected to the electricity network. Ensure your specialist CHP supplier includes within their scope for the administration of the G59 application and provision of on-site G59 testing which may, or may not, need to be witnessed by the DNO/IDNO (site attendance costs may be chargeable by the DNO/IDNO).

- .2 Ensure your specialist's appointment covers the completion and submission of all forms and all testing and commissioning that may be required to successfully complete the application.
- .3 The CHP connection must comply with Engineering Recommendation G59 published by the Electricity Networks Association (ENA). The CHP Control Panel shall include a mains monitoring and protection relay as required by ER G59.

3.0 System Components

3.1 Combined Heat and Power Unit

3.1.1 General Requirements

- .1 Supply the CHP with a water cooled, reciprocating type, spark ignition, gas fired engine. Ensure the system is suitable for continuous operation. Select a unit that operates with a standard engine operating speed of 1500 RPM.
- .2 Generate heat recovery for the LTHW heating system, using heat exchangers in the lubricating oil, engine cooling water and exhaust systems.
- .3 Install the CHP unit on a dedicated concrete plinth, using anti-vibration mounts.

3.1.2 Gas Supply Train

- .1 Make the gas connection to the CHP in accordance with section S32 of this specification.
- .2 Install a 200 micron gas filter, a gas meter, a gas pressure gauge, a low pressure relay, and an isolation valve in the gas pipework immediately prior to the CHP connection.
- .3 Connect the CHP unit to the site gas supply point via a flexible connection.

3.1.3 Engine

- .1 Ensure the CHP engine is designed for a minimum continuous operation of 1000 hours between servicing intervals.
- .2 Supply the engine with an oil level regulator, an integral top-up tank, a sight glass, a fill connection and a drain connection. Ensure the engine is designed so that it is not necessary to replenish the engine oil during the 1000 hour maintenance interval.

- .3 Supply the engine with:
- A 24V, maintenance free, lead acid battery;
 - 24V electric starter motor;
 - Ignition coil(s);
 - Ignition leads located to prevent damage from engine heat;
 - Spark plugs;
 - Inlet air filter;
 - A brushless, synchronous 2-bearing type, alternator, suitable for 400/230V, 50Hz, 3ph operation;
 - An engine cooling system;
 - An integral control system; and
 - All necessary internal power and control wiring.
- .4 Control the generator output voltage using a power factor correction regulator, capable of controlling the output power factor between 0.7 inductive and 0.9 capacitive.

3.1.4 Engine Cooling System

- .1 Supply the CHP engine with a sealed system cooling circuit.
- .2 Supply the cooling system complete with circulation pump, expansion device, fill and drain connections, control valves, LTHW heat exchanger, and all necessary temperature sensors and controls.
- .3 Ensure the system is designed to operate with a water/glycol mix.

3.1.5 Acoustic Enclosure

- .1 Supply the CHP with an acoustic enclosure to meet the noise criteria stated in the schedule.
- .2 Fit the acoustic enclosure with doors and access panels to allow easy access for all necessary servicing and maintenance.

3.2 Exhaust Systems

- .1 Design, supply and install a twin walled, insulated, stainless steel exhaust system for each of the CHP units as described in the System Description section above and as detailed on the Contract Drawings.
- .2 Construct all exhausts suitable to DW144 Class C leakage standards.
- .3 Ensure all exhaust discharges to atmosphere terminate in accordance with the CHP manufacturer's recommendations, the Clean Air Act and the requirements of the Local Authority's Environmental Protection Department.
- .4 Work closely with the architect to ensure all exhausts terminate in discrete locations and do not impair the aesthetics of the buildings.
- .5 Ensure that the CHP exhaust discharges are located such that exhaust gases cannot be drawn in by air handling plant or other ventilation systems.
- .6 Provide a shell and tube type exhaust gas heat exchanger with exhaust gases passing through the tubes and water flowing around the tubes.

- .7 Install silencers in the exhaust system to ensure the project internal and external noise limit requirements are achieved.
- .8 Ensure all exhaust systems are complete with all necessary steelwork supports, brackets, flashing plates, weathering aprons and cravats required to provide a complete and weatherproof installation. The installer shall allow for all brackets, restraints, restraining cables etc. necessary to support the length of exhaust. Co-ordinate with the Main Contractor to ensure that the necessary fixing eyes required are provided. Provide all necessary draft diverters, anchors and bellows for efficient operation of the CHP.
- .9 Install a low point drain on all exhausts that terminate vertically. Extend the system so that it discharges via a 15mm trapped copper Table X pipe over a plant room floor drain. The trap is to be sufficiently large to overcome the exhaust discharge pressure.
- .10 Ensure all exhaust components shall be constructed and assembled in accordance with BS EN 1856-1.
- .11 The responsibility for the detailed design and performance of the exhaust system to suit the installed CHPs shall be with the Mechanical Contractor.

3.3 Ventilation System

- .1 Supply the CHP unit's acoustic enclosure with sufficient ventilation connections mechanical ventilation to draw in air adequate for combustion and cooling.
- .2 Construct all ventilation systems suitable to DW144 Class C leakage standards.
- .3 As a minimum, install a ductwork system from the CHP extract connection to the exhaust louver on the perimeter of the building.
- .4 Where identified on the scheme drawings or in the Description of the Works section above, install a ductwork system from the CHP air intake connection to the air intake louver on the perimeter of the building.
- .5 Where fans are not provided as integral to the CHP, supply separate fans for the air intake and air extract connections. Site the fans to suit the air flow requirements of the CHP unit.
- .6 Insulate all air intake and air extract ductwork. Ensure the extract ductwork is sufficiently insulated to ensure all exposed surfaces are within 5°C of room temperature. Ensure all air intake ductwork insulation is vapour sealed.
- .7 Ensure the ductwork systems are suitable for the temperature and the pressure of the gases they are conveying.
- .8 Interlock all fans with the gas firing equipment to shut down the CHP on air flow failure.

3.4 Safety System

- .1 Supply and install a plant room fire protection system including fire alarm interface, knock-off buttons, and electro-thermal links (above each CHP), to shut off the gas supply if a fire is detected. Refer to Section S32 of this specification for details.



3.5 Painting, Thermal Insulation and Identification

- .1 Ensure all hot parts of the CHP units are insulated in accordance with section Y50 of this specification.
- .2 Label all Mechanical Services in accordance with section Y54 of this specification.

4.0 Testing and Commissioning

4.1 General Requirements

- .1 Test and commission the entire system in accordance with section Y51 of this specification.
- .2 Pressure test all pipework to 1.5 times the operating pressure.
- .3 Flush out, cleanse and chemically treat all water distribution system in accordance with section Y25 of this specification.
- .4 Commission all CHP units in accordance with the manufacturer's recommendations.
- .5 Regulate and balance all water distribution system in accordance with section Y51 of this specification.
- .6 Test operation of each safety valve and high limit thermostat.
- .7 Test pressurisation set, fire alarm, gas detection system and electro-thermal link interlocks/controls interactions.
- .8 Test the boiler sequence control, Lead/Lag changeover, burner modulation, gas booster operation and alarm indications to the automatic controls system.
- .9 Pressure test all ductwork and exhaust systems to DW144 Class C.

